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UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

FOREST UTILIZATION RESEARCH

at

RAPID CITY RESEARCH CENTER

Rocky Mountain Forest and Range Experiment Station

(A Project Analysis and Working Plan)

by

Eugene F. Landt

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Prepared:	Approved:	Date:
June 18, 1957	Richard M. Hurd Research Center Leader	6/18/57
	Division Chief	
	Director	

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FOREST UTILIZATION RESEARCH AT RAPID CITY RESEARCH CENTER

The Black Hills research area consists of a tree covered uplift about 120 miles north and south and about 60 miles east and west. Two-thirds is in southwestern South Dakota and one-third is in northeastern Wyoming. Gross area is about 3.5 million acres. Gross area of Black Hills National Forest is 1.5 million acres. About 2 million acres is in forest land. A favorable factor for tree growth and natural reproduction is that the period of heaviest precipitation is in May and June, when more than 15 inches of rain may fall, although the average is usually about 8 inches (19)[1/]. Total annual precipitation ranges from about 22 inches at one station in the north to 15 inches and less in the south, east, and west fringe.

The timbered area contains one of the most unique forests in this country. Here is an isolated forest in an almost treeless area. The commercial forest is largely ponderosa pine, (Pinus ponderosa) (95% of volume) with a small amount of white spruce, (Picea glauca var.-glauca) (5% of volume). This area does not have a problem of using low grade hardwoods nor low value softwoods as is present in many areas. Here is a well recognized high quality species that has been used extensively throughout the world. However, because of past use and less favorable growing conditions the ponderosa pine stands growing here may not be of the highest quality.

1/ Numbers in parenthesis refer to literature cited.

The total sawtimber stand of ponderosa pine is about 3 billion board feet. The total spruce sawtimber stand is estimated to be from 40 to 120 million board feet (19). This volume of spruce grows in the higher altitudes, north aspects, canyons, and other moist sites. The remainder of the forest is the natural site for the pine. An average ponderosa pine tree contains about 150 to 200 board feet and an average stand is about 5,000 board feet per acre. Logs seldom contain more than 50 to 70 board feet (4). The cut per acre is about 1,000 to 1,500 board feet. Wherever pine seed trees exist, natural reproduction occurs rapidly. Ponderosa pine young growth covers the ground so thick that in some areas it is referred to as "dog-hair" stands. Total volume of ponderosa pine young growth and including older small trees (6 to 10 inch d.b.h) is about 3.3 million cords (6) (2). With regulated cutting from 6 to 16 cords per acre could be harvested. Total spruce pulpwood volume is estimated at 123,000 cords in the northern Black Hills (6). Although a small additional amount of spruce is in the southern Black Hills, no volume estimate is currently available.

Black Hills ponderosa pine usually yields lower quality lumber than from other ponderosa pine regions. Lumber recovery in the select grades is from 7 to 10 percent while West Coast pine yields about 16 percent selects (8) (10). Although not a major cause of lumber degrade, red rot in overmature trees gives Black Hills timber a high cull factor (15 - 35 percent) (19). The larger amounts of lower quality lumber produced in this area is due mainly to the small poorly formed trees.

Strength tests of this pine have shown that the wood is slightly stronger than ponderosa pine of other areas (1).

Current use of the timber has not changed greatly from the earlier periods. Although both sawtimber and pole size trees have been used by the mining industry, the major product has been lumber. Practically all lumber that was cut during early settlement was used locally. Growth of local cities in the early 1900's caused lumber to be shipped in from the northwest region. Not enough of the higher lumber grades and special products could be produced to meet the demand. Products from other species than ponderosa pine were needed for house building. This caused strong competition with local lumber (19). Outside markets were needed to permit the expansion of the lumber industry. During this period one large mill was successful in improving utilization by marketing special products made from low-grade lumber. Many mills still produce only rough green lumber. However, mills are finding it increasingly difficult to stay in business because of the decreased demand for this product and the lower profits. As a result, a recent trend has been to more efficient operations designed for producing well manufactured and seasoned lumber.

Major products produced are lumber and lumber-by-products. Other products such as posts, poles, and pulpwood are only minor (about 10,000 cords per year). An average of about 50 to 60 million board feet of lumber is cut in the Black Hills area each year. The estimated potential total cut for 1956 was 66 million board feet (15). Even though

the cut for 1956 did not reach this value (1956 cut was about 50 million board feet), future cuts may approach it because of the recent increase in sawmill capacity of the area. Other products produced from sawtimber trees are molding, lath, mill work, paneling, and mine timbers. These products are marketed locally as well as in the adjoining states and further east.

Much of the lumber, especially rough green, is sold locally. This market consists of local ranches and remanufacturing yards such as lumberyards with drying and surfacing equipment. One such yard air seasons and surfaces lumber for a chain of Black Hills lumberyards. Most local lumberyards retail seasoned surfaced Black Hills ponderosa pine lumber. Other markets for well seasoned and manufactured lumber are retail yards in North Dakota, Nebraska, Iowa, Minnesota, Wisconsin, Wyoming, and Illinois. Much of the lumber marketed in these states is manufactured under Western Pine Association standards. Some sawmills sell through brokers while some of the small rough green mills sell locally or to anyone that comes along.

The sawmill economy is centered around small mills. A total of 49 mills produce lumber on a commercial scale (15). Forty-three are of the small circular-head rig type with average annual cuts ranging from .05 to 2.5 million board feet apiece. The other five mills have average annual cuts ranging from 3 to 5 million board feet. Only one mill cuts more than 10 million board feet per year. About 33 of these mills normally run at least 10 months out of the year. The capacity of the mills

in the Black Hills could reach 80 to 100 million board feet per year if full use could be made of existing equipment. Some of the part-time mills that are operated by farmers and ranchers with other sources of income have no desire to expand. Lack of capital to buy modern equipment and to buy a larger supply of logs appears to limit some of these small mills. Also, lack of desire to buy large amounts of low quality logs is another limiting factor.

These mills obtain logs from Federal, State, or private sources (15). However, most of the logs (70 percent) are cut on National Forest land. Private land furnishes about 17 percent and State land about 13 percent of the logs (15). Some of the small part-time mills operate almost wholly on private timber because of the flexibility of operation and ease of obtaining small amounts of timber.

Logging is mainly by horse skidding and power jammer loading. Logs are skidded out in various log lengths up to 16 feet long. One operation (Homestake Mining Company) skids with tractors in 32 foot sections. One new operation is planning to skid in 32 foot lengths with tractors. All hauling is by truck. Average haul distance is about 20 - 30 miles for some of the large mills cutting at least 2 million board feet a year. However, haul distances are less for the smaller circular mill.

Residues developed at these mills total about 61 thousand tons per year of sawdust, 46 thousand tons of slabs, edging, and trims, and 20 thousand tons of shavings. Logging residues generated in the form

of tops total about 39 thousand tons. Currently little use is being made of sawdust and logging tops other than small amounts for fuel. A few houses have sawdust burners. Small amounts of slabs are used for fuel and for windbreaks. One concentration yard surfacing over 2 million board feet per year, bale shavings for cattle bedding and sale rings. Shavings are also being used for fuel at five plants having dry kilns.

Manufacturing of lumber and wood products in South Dakota ranks third in manufacturing with respect to employment. Several small towns depend on sawmilling as a major source of income. Because of the increased allowable cut on the National Forest (from about 53 million in 1955 to about 60 million board feet in 1956) additional expansion of the sawmill industry in these towns is possible.

Limited markets exist for trees below sawlog size. A slight increase in demand for posts during World War II made possible commercial thinning of some of the pole stands. Currently, one pressure treating plant is using about 9,000 cords of this material per year. Six other non-pressure plants use a total of 1,000 cords. A new and as yet limited outlet is for pulpwood. Only experimental shipments have been made. Most of the shipments have been to three or four pulp mills in central Wisconsin. This is an outlet that would take large amounts of wood once the market is fully developed.

The fast changing wood utilization picture has caused problems in the use of the local wood. For example, the replacement of wood

by fiberboard for boxes reduced this outlet for some of the lower grades of lumber. Also wood grain doors are not being used in the great numbers they once were. Ties are no longer cut in the area. Western lumber is being used in the area in place of local wood. Requirements of building lumber are becoming more exacting. This means that improperly dried and manufactured lumber is not being used in the quantities that were used a few years ago. Black Hills ponderosa pine received a bad name when much of this improperly dried and manufactured lumber was being sold locally and to the surrounding states. Future utilization of the saw timber resource will improve only as fast as the products manufactured from the tree are improved and methods are developed for selling trees on a quality basis. The utilization of small material will depend on the development of markets. The objectives of forest utilization research are to encourage this improvement.

PROBLEMS

Increasing Cut of Pole Size Trees

Before intensive forest management can be realized, pole stands as well as sapling stands will need to be thinned. Commercial thinnings in pole stands cannot be made until an outlet is provided for the material.

Growth in unthinned pole stands is about 30 cubic feet per acre per year while in thinned stands growth is about 50 cubic feet per acre per year (17). A total of 300,000 acres of pole stands are in need of thinning. Thinning will increase volume growth as well as diameter growth for sawtimber trees left in the thinned stands. Increased use of material from thinnings will promote utilization of the small tree resource and stimulate the economy of the area. This will require the establishment of new industries.

Thinnings are suitable for pulpwood (16) and tests have shown that the wood makes good chemical and groundwood pulp (10) (11). A few trial shipments have been made to mills in the Lake States. Production cost of rough wood is about $13.00 per cord at the railroad siding in the Black Hills. This includes $1.65 for stumpage. The price that is currently being paid f.o.b. car in this area for rough ponderosa pine is $18.00 per cord. Freight charge to the Lake States is $12.36 per rough cord. Total cost to the Lake States mills is $32.36 per cord. This cost is high compared to the cost of wood

available to the mills from local sources ($17.00 to $28.00 per cord). However, Lake states mills are interested in soft woods from outside their area because of the current shortage of this kind of wood (7). Lower harvesting costs in the Black Hills would place ponderosa pine in a better competitive position for this outlet.

Ponderosa pine thinnings also have suitable characteristics for post and poles. Young ponderosa pine trees have thick sapwood (96% of volume) which takes preservative treatment well (16). Post and poles can be treated easily by either cold soaking or by pressure methods.

Thinnings could also be used to make particle board. The Wabash Screen Door Company and Curtis Companies, Inc., make a good particle board from ponderosa pine residues. Also a company in Deadwood, South Dakota is considering making particle board from ponderosa pine thinnings.

At least 1.2 million cords of ponderosa pine pulpwood (6" to 9" d.b.h.) are now available for harvest in the northern Black Hills (6). Probably another million cords are available in the southern Black Hills. An accurate volume for this area is not available. A forest survey is needed to give more accurate volumes on which to base future expansion of industry.

Growth occurring in these immature stands is based on estimate only. The National Forest has set the allowable cut of its pole stands at 80,000 cords per year. An additional 8,000 cords per year from state land and about 33,000 cords from private land have been estimated to be

available (3). Only about 9 to 13 percent of this available resource is being used (15).

Water may be the limiting factor for the development of a sulfate pulp mill. There is no large amounts of surface water available. However, great amounts of surface water are available on the Missouri River for such a plant (5). Underground water in amounts necessary to supply a 200 ton chemical pulp mill may be available from deep wells (4,000 to 5,000 feet deep). Sufficient surface water is known to be available for several 50 ton groundwood pulp mills which use much less water than chemical pulp mills. The possibility of a groundwood mill is being studied by a group in Deadwood, South Dakota. Also, some people in Newcastle, Wyoming are studying the possibility of a small chemical pulp mill or a groundwood plant.

Location, volume, and properties of the resource are needed to help these interests complete plans for establishment of industries to use the pole size stands. Information on better methods of harvesting these stands is also needed to make possible reduction of logging costs. Even a small reduction may mean establishment of an outlet for this material.

Increasing Cut of Saw Log Size Trees

The allowable cut of sawtimber on the National Forest has not been completely utilized in the past. For the period from 1921 to 1953 the actual cut averaged about 68 percent of allowable cut (20). During the past three years actual cut has been slightly more than one half of the allowable cut (20). This gap between actual and allowable cut could be closed by expanding existing sawmills. This would be possible only if the mills wanted to expand and could lower existing high operating costs.

These high operating costs are due in part to the small low quality logs being cut and also to poor sawmill practices. Small logs yield low amounts of the higher grades of lumber. Mill operators complain about the large number of small low quality logs they are required to cut (15). They state that stumpage prices are too high and that quality of timber is not recognized in selling the trees (15). Because of this the National Forest has a problem of selling timber to operators who are dissatisfied with the present practices. To help sell more timber a system recognizing quality is needed to properly evaluate standing trees so that operators can know what they are buying. Also to help solve the problem of increasing the cut of saw log trees, the local sawmills need to increase their capacities and improve their efficiency.

In the past, utilization practices in small mills have tended to drop due to the lack of new or replacement equipment and because a profit could be made by cutting only rough lumber products (15). Now that such profits are no longer possible (rough green lumber sells for about $60 to $65 per thousand board feet and manufacturing costs can be as high as $68 which includes $10 for stumpage)(15) the sawmills will need to use modern equipment and introduce new methods to stay in business.

Increasing the cut of sawtimber is important in helping improve the economy of the area. Manufacturing of lumber and wood products in South Dakota ranks third in manufacturing as to employment. There are 19 sawmills that would be affected and could contribute to a better economy by increasing their cuts. One reason for a lag in production rates is that lumber manufacturing costs in the Black Hills are higher than in other ponderosa pine production areas of the west (21). For example, mill operating costs per thousand board feet of Black Hills surfaced and dried lumber are $78.14 as compared to an average of $72.33 in southern Wyoming and northern Colorado, and $70.69 in southwestern Colorado (21). In the California pine region sawmilling costs (sawing, planing, and loading) make up about 22 percent of conversion costs whereas in the Black Hills 35 percent is used in sawmilling (4). Logging costs are about the same in the Black Hills as in the Rocky Mountain region (21). These higher manufacturing costs at Black Hills mills reflect the relatively

poor efficiency and poor lumber-handling practices characteristic at small sawmills cutting small logs. To offset these higher costs modern sawing and handling equipment can be used. Although circular sawmills are adapted to cutting small logs they are not as efficient as various combinations of resaws and gang saws for this purpose. For example, by using a combination of twin circular saws and a gang saw it is possible to reduce sawing costs of small logs. More specific information on operating costs is needed to evaluate the efficiency of the local sawmills.

Sawmills of the Black Hills cut in 1956 a total of about 50 million board feet--log scale. This included a cut of about 31 million board feet on National Forest land (20), about 8 million on state land in South Dakota and Wyoming, and 11 million board feet on private land (15). Allowable cut of sawtimber on National Forest land in 1955 was about 52 million board feet. In 1956 this was raised to about 60 million board feet per year. Allowable cut on South Dakota State land has been set by law at 6 million board feet. Actual cut has been averaging about 2 to 4 million board feet per year. Estimates are not available on allowable cut on private and other State lands. This may be as much as 14 million board feet per year.

Sawtimber is sold generally on the stump and not as logs. The Forest Service sells timber on the basis of a tree scale. The State of South Dakota also sells on tree scale. Private land owners

usually sell on log scale. Tree volumes are determined from volume tables which are adjusted by check scaling logs from selected check trees. Current log prices (total amount including sale betterment and slash) range from about $12.00 to $20.00 per thousand board feet on National Forest land; $10.00 on private land, and $10.00 to $12.00 on state land. Trees of 10 inches d.b.h. and larger are marked. Trees are utilized to an 8 inch top. An average of from 1,500 to 3,000 board feet per acre is usually cut. Trees contain about 120 board feet and logs seldom contain more than 50 to 70 board feet. Black Hills ponderosa pine has always had a high cull factor (15 to 35%) due to red rot in overmature trees. All of these factors will influence the value of standing trees and additional data is needed to determine the extent of this influence.

Skidding of logs is done mainly by horses. However, the largest mill in the area (Homestake) uses tractors and arches. National Forest timber sale contracts encourage the use of horses. However, tractors can be used with special permission. Loading is usually by power jammer, although, cross haul and log rollways are also used. Log haul is by trucks. Average haul distance is from 20 to 30 miles. Logging costs are about the same in the Black Hills as in other areas.

Lumber is sold to lumberyards, to local ranchers, to remanufacturing plants and to wholesale and retail yards in adjoining states. Rough green lumber is usually sold to local remanufacturing

plants and to local ranchers. Surfaced and dry lumber is marketed either out of state or through brokers. Improperly manufactured Black Hills lumber has caused some local resistance. However, lumberyards handling well manufactured products have little trouble selling local lumber. Some difficulty is experienced by sawmills in finding markets for narrow boards (4 and 6 inch widths). Special uses could be found for this kind of material such as laminating, or in paper overlaid panels to help increase the market for low grade narrow lumber.

Expansion of mills to increase the cut of sawtimber trees should be by mills that can properly manufacture and season lumber. To help mills expand, information on the value of standing trees is needed. Tree value should be based on tree quality, products that can be produced, location of the trees, volume of stand to be cut and other factors related to manufacture of lumber.

Finding new uses for sawtimber trees also will help increase the cut. New uses for narrow boards and the lower grades of lumber can be found by cooperating with various State, private and Federal agencies engaged in forest products research.

Increasing the Use of Logging and Milling Residues

Only a small part of the residues produced by lumbering operations are now being used. Location of markets, scattered small capacity sawmills, and lack of capital to develop methods of processing residues have contributed to this lack of use. Mill residues at present are a curse rather than a blessing to the operators because it costs money to dispose of them. This must be charged against the cost of producing lumber. Outlets are needed for large amounts of residues to increase returns to the operators. They would no longer have a problem of disposal and would be able to decrease their cost of operation. New industries to use residues would improve the economy of the area by creating more jobs.

Annual residues produced by lumbering operations are roughly estimated at 61 thousand tons of sawdust, 46 thousand tons of slabs, edgings and trim, 20 thousand tons of shavings, and 39 thousand tons of logging tops (15). Half of a log becomes residue when cut for lumber (9). This is a sizeable resource and would be adequate for establishment of new industries. For example, slabs, edgings and trim are suitable for pulp chips and for particle board. Particle board is also a possible outlet for shavings.

The use of residues for these purposes depends upon establishment of markets. However, because this area is far from existing plants the shipment of residues out of the area appears unlikely. Therefore new industries will have to be encouraged to come into

the area. The establishment of a particle board plant in Deadwood, South Dakota is in the planning state. These potential industries need to know the location, volume and properties of residues on which to base plant construction.

Improving Wood Quality

Sawmill operators complain about the low quality logs that are available in the Black Hills sawtimber stands. Lumber recovered from these logs consist mainly of the common grades. Only about 7 percent of the lumber is in the select grades (8). Many trees are poor in form. Also limbs persist for many years. These conditions cause low quality lumber. Improving mill efficiency can improve grade recovery only so much. Additional improvement can only be made by improving the quality of the trees. Improper silviculture practices can cause trees to form poor quality wood. Wood with low specific gravity and fibril angles that depart more than 10 degrees from longitudinal axis of wood fibers may result. However, by using good practices wood quality can be improved in future stands.

Proper pruning will cause a tree to grow clear wood much earlier than if the limbs were left to drop off by themselves. This will cause greater yields of the higher lumber grades. Pruning will also control red rot in young pine trees. The value of pruning in Black Hills ponderosa pine needs to be determined. The time required to grow clear lumber is the important factor to be evaluated. Cline and Fletcher (12) estimated the profit from pruning white pine to be $15.00 to $35.00 per thousand board feet.

Thinning practices can also be used to improve wood quality. The influence of thinning on specific gravity and fibril angle is

not known and needs study. The influence of tree spacings on wood quality also needs evaluating. By use of these practices it may be possible to grow wood with special qualities desired for a specific product.

Wood quality can be evaluated by measuring specific gravity and fibril angles in tracheids. The effect of increase in growth rate or fiber yields can be accomplished by increasing specific gravity of wood (13). Small fibril angles, less than 10 degrees, have been found to be associated with the favorable strength and dimensional stability of such wood as that of the southern yellow pines and the good tearing strength of kraft paper made from these woods (12).

Coordinated research in this field is needed between forest management research and forest utilization research to fully evaluate effective forestry practices for growing wood for special uses. Principal uses in the Black Hills would be for lumber and pulp. The function of forest utilization research would be to evaluate the effect of silviculture practices upon wood quality.

One way to improve future stands is to leave plus trees for a seed source. To do this identification of plus trees is necessary. Work needs to be done in correlating external tree characteristics with desirable specific gravity values and fibril angles.

WORKING PLAN

This section contains proposed studies for the solution of problems discussed in the project analysis.

Two groups of studies are listed under each problem heading. Those to be initiated in the next five years and those to be initiated later. Each study to be undertaken within the next five years is outlined with proposed starting date. Studies to be started later are listed by title and in order of priority but without starting dates.

Increasing Cut of Pole Size Trees

Before markets and outlets can be established or new industry established we need to know the volume of pole size trees, location of these stands, specific tree properties, and improved methods of harvesting.

Studies described here involve 1. measurement of available small tree stand volume, 2. the determination of quality and characteristics for various uses, and 3. the evaluation of harvesting methods.

Proposed studies to be initiated within the next five years are described in this section. Studies to be initiated later are listed at the end of this section and numbered in order of priority.

Survey of Pulpwood Resource in the Northern Black Hills

PURPOSE: Supply local industry with location and volume of available pulpwood in Northern Black Hills.

OBJECTIVES: Determine available pulpwood volume in the Northern Black Hills.

GENERAL LOCATION: All lands in Black Hills north of base line excluding Bear Lodge Mountains.

GENERAL PROCEDURES: Sample volume of two age classes: 51 to 100 years on 103 sample plots randomly located over area. Measure pulpwood trees (5.0 to 9.9 inches d.b.h.) on 1/25 acre sample plots by 1-inch diameter classes, merchantable height to a 4-inch inside bark diameter. Black Hills marking guide will be used to mark the cut and leave trees.

START: 1955

FINISH: Field work - 1955; publication in rough draft - 1956.

Characteristics of Ponderosa Pine Pulpwood

PURPOSE: Collect information on pulpwood properties to encourage use of the pulpwood resource.

OBJECTIVES: To measure physical properties of Black Hills ponderosa pine pulpwood.

GENERAL LOCATION: Black Hills and Bear Lodge Mountains.

GENERAL PROCEDURES: One and a half cords of 100 inch long pulpwood will be cut from 39 plots. Plots will be selected to cover yellow bark, thinned and unthinned stands and marking guide areas 1, 2, and 3. These plots will be located on limestone and crystalline soils. Pulpwood stack measurements will be taken on both rough and peeled wood. The following properties will be measured: specific gravity; solid wood per cord; rings per inch; gravity rate; bolt diameter; number of bolts per cord; shrinkage from rough to a peeled stack; bark volume; and weight. Results will be published in a technical journal.

START: 1956

FINISH: Field work 1956. Publication in rough draft 1957.

Season of Treatment for Chemical Debarking of Ponderosa Pine

PURPOSE: To find a low cost method of producing peeled pulpwood.

OBJECTIVE: To determine the length of season that can be used to chemically treat girdled trees for maximum bark loosening.

GENERAL LOCATION: One area in central Black Hills.

GENERAL PROCEDURE: Pulpwood size trees of high and low vigor will be girdled and treated with a 10% sodium arsenate compound. Treating will be at two week intervals in spring and summer. Girdling and treating times will be measured. Half of the trees will be evaluated for peelability the first fall and the other half evaluated the next spring. Period of treatment corresponding to complete bark loosening on trees treated during that period will be designated as the treating season. Peeling times will be taken so that an estimate of costs can be obtained.

START: 1957

FINISH: Field work 1958. Publication in rough draft 1959.

Survey of Pulpwood Resource in Southern Black Hills and Bear Lodge Mountains

PURPOSE: Encourage use of pulpwood resource by determining available volumes.

OBJECTIVES: Determine available pulpwood volume in the Southern Black Hills and Bear Lodge Mountains.

GENERAL LOCATION: All lands in Black Hills south of base line and including Bear Lodge Mountains.

GENERAL PROCEDURE: Sample volume of two age classes: 51 to 100 years and 101 plus years on an adequate number of sample plots to give ± 15 per cent accuracy. Measurements will be made on pulpwood trees (6.0 to 12 inches d.b.h.) on 1/25 acre sample plots by 1-inch diameter classes, and to a merchantable height of 4-inch inside bark diameter. Black Hills marking guide will be used to mark cut and leave trees. Volumes will be reported for 6 to 9 inch classes and for the 6 to 12 inch classes.

START: 1958

FINISH: Field work 1958. Publication in rough draft 1959.

COOPERATION: Study to be done by forestry school personnel under supervision of Rapid City Research Center.

Evaluation of Harvesting Methods of Ponderosa Pine Pulpwood

PURPOSE: Encourage use of pulpwood resource by supplying cost data on methods of harvesting pulpwood.

OBJECTIVE: To determine the cost of harvesting pulpwood in the roundwood form and in the chip form.

GENERAL LOCATION: Black Hills area.

GENERAL PROCEDURES: On a representative stand of pulpwood (age 50 to 100 years) determine logging and hauling costs of roundwood. Existing pulpwood operations will be used. On same stand determine cost of producing and hauling unscreened bark free chips. Make a trial shipment of 10 cars (200 units or 200 cords) to a Lake States pulpmill of both forms of wood. Contacts will be made with a Lake States mill and Forest Products Laboratory for cooperation and evaluation of chips and methods of harvesting. Contacts will also be made with chipping and debarking equipment manufacturers for cooperation in furnishing a debarker chipper combination machine. Tree length barking and chipping will be tried. Chips will be sold to a Lake States mill for their use in an experimental pulp cook.

START: 1960

FINISH: Field work 1960. Publication in rough draft 1961.

Proposed Future Studies

Studies needed but not to be initiated within the next five years, in order of priority are:

1. Suitability of ponderosa pine thinnings for the production of charcoal.
2. Fence post requirements in local area.
3. Cold soaking ponderosa pine fence posts in pentachlorophenal.
4. Suitability of pole size trees for sliced veneer.
5. Suitability of ponderosa pine thinnings for production of molasses.
6. Suitability of ponderosa pine for poles.

Increasing Cut of Saw Log Size Trees

To increase the cut of saw log size trees existing sawmills will have to increase their cut or new mills will need to be established. To make this possible a better understanding of the problems in sawmilling is needed. Also to encourage expanded and new sawmill operations information is needed on what kind of raw material is available and the efficiency of various kinds of mills. A measure of tree quality is also needed by the Forest Service to encourage the operators to buy more timber.

Studies described here involve: 1. determining the characteristics of the wood using industries; 2. measuring the quality and amount of lumber produced from logs and 3. determining tree value.

Proposed studies to be initiated within the next five years are described in this section. Studies to be initiated later are listed at the end of this section and numbered in order of priority.

Characteristics of Wood Using Industries

PURPOSE: To become acquainted with the wood using industries and to collect information for future research planning.

OBJECTIVES: To determine the number and kind of wood using industries, products produced, and production rates.

GENERAL LOCATION: Black Hills area.

GENERAL PROCEDURE: Contact all sawmills, post and pole plants and wood concentration yards. Collect data from each operation regarding plant equipment, period of operation, number employed, plant production rate, volume cut, source of raw material, and location of markets. Characteristics on capacities, kinds and amounts of products plus other mill properties will be reported in a station paper.

START: 1956

FINISH: Field work 1956. Publication in rough draft 1957.

Strength of Ponderosa Pine

PURPOSE: To fill the need for information about the strength of Black Hills ponderosa when used as structural lumber.

OBJECTIVES: To determine basic strength properties of Black Hills ponderosa pine.

GENERAL LOCATION: Central Black Hills.

GENERAL PROCEDURES: Eight trees will be selected from a representative mature sawtimber stand (160 plus years). An eight foot section from seven trees and the total merchantable portion of the eighth tree will be sent to the Forest Products Laboratory for basic strength tests.

START: 1956

FINISH: Field work and test 1956. Publication in rough draft 1957.

COOPERATION: Forest Products Laboratory.

Buckingham Wood Products Company, Inc.

Lumber Grade Recovery from Ponderosa Pine Logs

PURPOSE: To relate lumber grade recovery to external log characteristics.

OBJECTIVES: To determine the lumber grades recovered from logs with various external characteristics. Develop method for predicting lumber grade recovery from logs.

GENERAL LOCATION: Four sawmills in Black Hills area.

GENERAL PROCEDURES: Lumber grade recovered from graded logs will be measured at four different type mills 1. circular head rig and band resaw; 2. circular heading and gang saw; 3. circular head rig and circular resaw and 4. standard circular head rig. All logs will be diagrammed and graded. Two to three days run will be measured at each mill. Logs will be selected at random for first part of run. Then diameters and grades will be selected to fill in where needed to make a larger sample. All lumber will be graded by a Western Pine Association grader. Seasoning degrade will be measured at one or two mills. Pacific Northwest ponderosa pine log grades will be tested as a method for predicting lumber grade recovery from logs. Adjustment will be made in this system if necessary. I.B.M. System of computation of results will be used. Results will be reported in a station paper.

START: 1957

FINISH: Field work 1957. Publication in rough draft 1958.

COOPERATION: Western Pine Association.

Local sawmills, Region 2, Black Hills National Forest.

Application of Log Grades to Standing Trees

PURPOSE: Recognize quality in the standing tree.

OBJECTIVES: Develop grades for standing trees.

GENERAL LOCATION: Black Hills area.

GENERAL PROCEDURES: Ten logging operations will be visited where random trees will be graded on the basis of adjusted log grades determined during the previous summer. One week will be spent at each operation. After the graded trees are felled and bucked the individual logs will be examined and graded. The log grades for the tree will be averaged (weighing may be necessary) and this average compared to the original grade assigned the tree. Adjustments will be made in tree grading until criteria can be established that will give reasonable accuracy.

START: 1958

FINISH: Field work 1958. Publication in rough draft 1959.

Logging and Milling Costs

PURPOSE: To relate tree and log quality to logging and milling costs.

OBJECTIVES: To determine manufacturing costs for various log grades.

GENERAL LOCATION: Black Hills area.

GENERAL PROCEDURES: Times will be determined for producing finished lumber at the same four logging operations and sawmills used in the lumber recovery study. Times will be recorded by log diameters. Break even trees and logs will be calculated based on log and tree quality. Basic information on time required to produce lumber for various kinds and sizes of logs will be collected for use later in determining tree value.

START: 1959

FINISH: Field work 1959. Publication in rough draft 1960.

Determining Value of Standing Ponderosa Pine Trees

PURPOSE: To determine value of standing sawtimber trees.

OBJECTIVES: To develop a method of appraising tree value based on log and tree grade and associated logging and milling costs.

GENERAL LOCATION: Black Hills area.

GENERAL PROCEDURES: Information on lumber grade recovery, log grade recovery, tree quality, logging and milling costs will be used to develop a method of calculating tree value. Information or factors influencing appraisal of tree value as used by the Forest Service and sawmill operators will be collected. These factors along with above information will be combined to form a system for determining tree value. Specific procedures for developing this system will be a part of the work. Much of this study will be office work using existing data. The system for determining tree value will be published in a station paper.

START: 1960

FINISH: Office work 1960 and part of 1961. Publication in rough draft late 1961 or early 1962.

Proposed Future Studies

Studies needed but not to be initiated within the next five years, in order of priority are:

1. Improve sawmill efficiency (in cooperation with Forest Products Laboratory and Extension Forester).
2. Improve harvesting methods (in cooperation with Extension Forester).
3. Properties of lumber from young (100 plus years) second growth trees.

Cooperative studies that could be conducted with federal, state or private agencies conducting forest products research.

1. Suitability of Black Hills ponderosa pine for paper overlaid veneer and lumber.
2. Evaluation of paper overlaid ponderosa pine siding.

Increasing Use of Logging and Milling Residues

To increase the use of residues outlets are needed. New residue using industries would be an outlet. Information is needed on the amount, location, and properties of residues on which to base such industries. Studies described here involve the determination of residue volumes, location and the measurement of properties.

Proposed studies to be initiated within the next five years are described in this section. Studies to be initiated later are listed at the end of this section and numbered in order of priority.

Logging and Milling Residues in the Black Hills Area

PURPOSE: Determine amounts of residues produced in the Black Hills area.

OBJECTIVES: To develop conversion factors for determining volume of logging and milling residues.

GENERAL LOCATION: Black Hills area.

GENERAL PROCEDURES: This study is to be conducted in two parts.

Part 1. To determine residue volumes by weighing slabs, edgings, and trim from sample logs cut at four types of sawmills. Determine sawdust volume by diagramming saw cuts. Analysis of residue production will be on the basis of log size and quality. Logging tops will be measured by volume and weight determinations.

Part 2. To determine residue properties such as solid wood content of slabs, edgings, and logging tops, and the weight per cubic foot of sawdust and chips.

START: 1959

FINISH: Field work 1959 - Part 1; 1960 - Part 2. Publication in rough draft 1961.

Proposed Future Studies

Studies needed but not to be initiated within the next five years, in order of priority are:

1. Yield of pulp chips from residues (slabs and edgings).
2. Suitability of residues for charcoal.
3. Suitability of residues for production of molasses.

Improving Wood Quality of Black Hills Ponderosa Pine

Improvement of wood quality can be accomplished by silviculture practices and through genetics. Evaluation of these practices on wood quality is needed to determine the most effective treatments for producing wood with specific properties. The silviculture and genetic practices will be initiated by forest management research and forest utilization research will evaluate the influence of these practices on wood properties.

Studies described here involve 1. measurement of wood properties that are indicators of wood quality and 2. identification of high quality wood from external tree characteristics.

Proposed studies to be initiated within the next five years are described in this section. Studies to be initiated later are listed at the end of this section and numbered in order of priority.

Influence of Thinning on Wood Quality

PURPOSE: Investigate influence of thinning on wood quality.

OBJECTIVES: To determine effects of spacing on specific gravity and fibril angle of ponderosa pine.

GENERAL LOCATION: Plots selected for study of space requirements of ponderosa pine by timber management research.

GENERAL PROCEDURES: Increment cores will be taken from trees 5 and 10 years after thinning. Specific gravity and fibril angle will be determined on each core. This will be done jointly with forest management and forest utilization personnel.

START: 1959

FINISH: First examination 1964. Final examination 1969. Final publication 1970.

Proposed Future Studies

Studies needed but not to be initiated within the next five years, in order of priority are:

1. Identification of plus trees.

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